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AUTHOR Bate, Gwen M.; Pate, James L.
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ABSTRACT

This study investigated the relative effectiveness of verbal and visual modes of presentation on the learning of paired-associates by 64 3-year-old and 64 8-year-old children. Nine pictorial paired-associates and 9 verbal paired-associates were formed from pictures or names of familiar objects. At each age level, 8 male and 8 female subjects were assigned to one of 4 presentation conditions: (1) auditory, (2) visual sequential (subjects were shown the stimulus picture of each pair for 2 seconds followed by the response picture for 2 seconds), (3) visual simultaneous-2 seconds exposure (subjects viewed each stimulus response pair simultaneously for 2 seconds), and (4) visual simultaneous-4 seconds exposure (subjects viewed each stimulus-response pair simultaneously for 4 seconds). Following presentation subjects were tested individually for recognition in 3 trials. Results showed that the overall performance of 8-year-olds was significantly better than that of 3-year-olds in all conditions; however, the initial performance of the two groups did not differ significantly. The 8-year-olds showed improved performance only on the second and third trials. Only the visual-simultaneous conditions produced a significant difference in the mean number of correct responses when compared with the auditory mode of presentation. It is concluded that the influence of mode of presentation on learning is a complex phenomenon. (BRT)

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THE EFFECT OF MODE OF PRESENTATION ON THE LEARNING OF PAIRED-ASSOCIATES AT TWO LEVELS OF DEVELOPMENT

Gwen M. Bate and James L. Pate
Georgia State University

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The Effect of Mode of Presentation on the Learning of Paired-Associates at Two Levels of Development

Gwen M. Bate and James L. Pate

Georgia State University

The present research was designed to investigate the relative effectiveness of auditory and visual modes of presentation on the learning of paired-associates by children at two developmental levels, ages three years and eight years. This is not a new subject of investigation in the field of child development, for it has both practical and theoretical implications. From a practical point of view, educators are concerned about the optimal emphasis on pictorial versus verbal presentation at different age levels. From a theoretical standpoint, two positions are tenable. The cognitive-developmental view has, as a central tenet, the distinction between three modes of representation, action, imagery, and language, as landmarks of development; imagery representation is related to the visual mode of presentation, and language representation is related to the auditory mode of presentation. The learning theory view holds that practice with a particular form of stimulation is the most potent variable in determining the influence of presentation mode on learning.

Several investigators have attempted to determine whether visual and auditory modes of presentation affect children's learning of paired-associates differentially at various ages (e.g., Budoff & Quinlan, 1964; Cooper & Gaith, 1967; Hill & Hecker, 1966; Jones, 1973). However, the contradictory findings across studies are difficult to interpret in terms of establishing a developmental index for the effect of mode of presentation or in terms of finding unequivocal support for a particular theoretical position. An examination of the studies available indicates that the inconsistent findings across studies may reflect the variations

in methodology such as differences in material used (i.e., pictures vs words), differences in task requirements (i.e., anticipation vs study-test method; recognition vs recall test), and differences in the presentation conditions for visual and auditory modes (i.e., simultaneous vs sequential presentation). An additional source of variation is apparent in the age levels studied; the range of ages compared across studies probably represents the reality of subject availability rather than some systematic effort at comparing different age levels. Keeping these potentially critical methodological and subject variables in mind, three factors were considered carefully in the design of the present study: 1) the ages of the subjects, 2) the equating of auditory and visual modes of presentation, and 3) the test response.

The selection of ages three years and eight years was made on the basis of findings in a number of investigations which suggest that six is the critical age in the child's development in terms of the shift in the level of cognitive functioning (e.g., Hansen, 1971; Piaget, 1954) and the influence of language on learning (e.g., Kendler & Kendler, 1962; White, 1965). Therefore, it appeared reasonable to include children considerably above as well as below the age of six in order to optimize opportunities for differential effects of mode of presentation of paired-associates at the developmental levels to be observed.

In order to assess the importance of equating more nearly the presentation conditions in the two modes of presentation, three conditions of visual presentation were included. Picture paired-associates were presented to two groups of subjects at each age level in the typical simultaneous manner; one group received a two-second simultaneous exposure while the other group received a four-second simultaneous exposure. In a third visual presentation condition, stimulus items were presented for two seconds followed by a two-second exposure of response items. Aurally presented material was administered sequentially in the typical manner with two seconds between the stimulus item and the response item.

A recognition task, rather than a recall task, was used to measure learning. The use of a recognition task in which subjects are tested with items presented in the manner in which they have been studied should eliminate the potential difficulty of translating visual information into a verbal response. Subjects were required to respond "yes" or "no" to three response items (the correct response and two intralist distractor items) for each stimulus presented. An additional attempt to equate learning and test conditions was made by requiring that the visual recognition task items be presented either simultaneously or sequentially as appropriate for the learning condition.

Based on the two theoretical positions mentioned above three predictions were made:

1) the number of correct responses of eight-year-old children would differ significantly from the number of correct responses of three-year old children in each mode of presentation;

2) the performance of three-year-old children, according to the cognitive-developmental position, would be in the following order from most to least efficient learning--visual simultaneous-4 second exposure, visual simultaneous-2 second exposure, visual sequential, auditory; the performance of three-year-old children, according to the learning theory position, would be in the following order from most to least efficient learning--auditory, visual simultaneous-4 second, visual simultaneous-2 second, visual sequential;

3) the performance of eight-year-old children, according to the cognitive-developmental position, would be in the following order from most to least efficient learning--auditory, visual simultaneous-4 second, visual simultaneous-2 second, visual sequential; the performance of eight-year-old children, according to the learning theory position, would be in the following order from most to least efficient learning--visual simultaneous-4 second, visual simultaneous-2 second, visual sequential, auditory.

METHOD

Subjects

Subjects were 64 three-year old and 64 eight-year-old Caucasian children from middle to upper socio-economic levels, with equal numbers of males and females at each age level.

Materials

Nine pictorial paired-associates were formed from a group of eighteen black and white line drawings of familiar objects. Nine verbal paired-associates were formed with the names of the objects. Response members were assigned randomly to stimulus members and then reassigned to avoid any obvious associations. The two distractor items which were used in the recognition test were selected randomly from the response items with the restrictions that each response item was used three times and that each response item was presented in each of the three test positions.

Presentation Conditions

At each age level, eight male and eight female subjects were assigned randomly to one of four presentation conditions--auditory, visual sequential, visual simultaneous-2 seconds exposure, visual simultaneous-4 seconds exposure. The inter-pair interval in each condition was three seconds and the inter-trial interval was 20 seconds. Across conditions, subjects were required to respond "yes" or "no" to items in a three-choice recognition test (the correct response and two intra-list distractor items).

In the auditory condition, the experimenter spoke slowly and distinctly. The stimulus item and the response item were separated by 2 seconds. Following each study trial, the experimenter presented the stimulus followed by the choice items at a rate of one word every two seconds.

Subjects in the visual sequential condition were shown the stimulus picture of each pair for 2 seconds followed by the response picture for 2 seconds. Between each stimulus-response pair, subjects viewed a blank white page for 3 seconds. On

test trials, subjects were shown the stimulus for 2 seconds followed by the choice items, each exposed for 2 seconds. Following the third choice item for each pair, a blank white page was exposed for 3 seconds.

In the visual simultaneous-2 seconds exposure condition, subjects viewed each stimulus-response pair simultaneously for 2 seconds followed by a blank white page for 3 seconds. On test trials, the stimulus item, the correct response item and the two distractor items were presented simultaneously for 6 seconds, followed by a blank white page exposed for 3 seconds.

The procedure in the visual simultaneous-4 seconds exposure condition was the same as that in the 2 seconds exposure condition except that each stimulus-response pair was presented for 4 seconds during study trials and the stimulus item and the three choice items were exposed for 12 seconds on test trials.

Procedure

Subjects were tested individually. Prior to the presentation of the experimental materials, two study-test trials were presented with three practice paired-associates in the mode appropriate for each condition. Subjects who were not able to understand the task requirements were replaced. Following the practice trials, each subject received three study-test trials with intra-list order randomized for each of the three study and test trials.

RESULTS

Correct responses were analyzed in a 2x2x4x3 analysis of variance with age, sex, and mode of presentation as between-subject variables and trials as a within-subjects variable. The Newman-Keuls test was used for post-hoc comparisons. Main effects were found for age, mode of presentation and trials. The age effect confirmed the prediction that the number of correct responses for eight-year-old subjects would exceed the number of correct responses for three-year-old subjects.

Analysis of the main effect for mode of presentation indicated significant differences between the means for visual sequential presentation and visual sim-

ultaneous-2 second presentation, q (3,112)= 6.13, $p<.01$, and visual simultaneous-4 second presentation, q (4,112)= 8.17, $p<.01$; and between the auditory presentation and visual simultaneous-2 second presentation, q (2,112)= 5.40, $p<.01$, and visual simultaneous-4 second presentation, q (3,112)=5.93, $p<.01$. No other pairs were significantly different.

The predicted Age by Mode of Presentation interaction was not found. In fact, the rank order of correct responses in the four modes of presentation is identical for eight-year-old subjects and three-year-old subjects. (See Table 1)

The significant effect for trials is reflected in the general increase in the level of correct responding across trials; the means for Trials 1 & 2 differed, q (2,224)= 7.30, $p<.01$, as did the means for Trials 2 & 3; q (2,224)= 5.88, $p<.01$.

While as stated, the main effects of both age and trials were significant, these effects must be interpreted with care as the Age by Trials interaction also was significant. As shown in Table 2, the mean number of correct responses of eight-year-old subjects differed over trials with an increase in correct responding from Trials 1 to 2, q (2,224)= 8.06, $p<.01$, and Trials 2 to 3, q (2,224) = 7.13, $p<.01$, while no significant difference in the mean number of correct responses over trials was found for the three-year-old subjects. While eight-year-old subjects performed better on each trial, it should be noted that three-year-old subjects and eight-year-old subjects did not differ in the mean number of correct responses on Trial 1.

The finding common to both age groups in every analysis performed was the consistent inferiority of the visual sequential presentation. The apparent difficulty of this task relative to the other presentation modes was observed also in the rejection of three-year-old male subjects due to their failure to understand the requirements of the task as demonstrated in the practice trials. The 21 three-year-old subjects who were rejected appeared to be distributed somewhat evenly across sex and mode of presentation conditions with the exception of male subjects in the visual sequential condition.

DISUCSSION

The prediction that the behavior of eight-year-old subjects would differ significantly from that of three-year-old subjects in a paired-associate recognition task was not confirmed without qualification. While the overall performance of the two age groups did differ significantly, the initial performance, that is, correct responses on Trial 1, did not differ significantly. The differences on Trials 2 and 3 are a result of improved performance of the eight-year-old subjects. The three-year-old subjects showed little change across trials. These data are consistent with research which indicates a difference in the use of learning strategies as a function of developmental level (e.g., Stevenson, 1972). If it is assumed that the preschool child either lacks the capacity for mediation (e.g., Reese, 1962) or the ability to utilize mediators effectively (e.g., Flavell, Beach & Chinsky, 1966), it would be expected that the efficiency of strategies would not increase over trials for the three-year-old subjects but would increase over trials for the eight-year-old subjects. This interpretation was supported in a recent study conducted by Bate and Pate (1975) in which the materials and procedure for the visual simultaneous-4 second presentation of the present study were used with three-year-old subjects. When verbal mediators, sentences, were provided on each trial by the experimenter, learning was facilitated such that correct responding increased significantly from Trial 1 to Trials 2 and 3.

Another potential deterrent to increases in the number of correct responses over trials is the interference provided by intra-list distractor items on the recognition test. Interference combined with less efficient learning strategies may have increased the deleterious effect on the performance of three-year-old subjects relative to the effect of interference alone in the case of the eight-year-old subjects. A study by Bate and Pate is in progress which will make possible the assessment of the effects of intra- vs extra-list distractor items in both visual simultaneous and visual sequential presentation conditions.

The absence of an Age by Mode of Presentation interaction clearly contradicts

the prediction that mode of presentation differentially influences the learning of paired-associates at the two developmental levels observed. On the basis of this finding, the existence of a developmental difference in the effect of mode of presentation may be questioned; however this report must be considered more suggestive than conclusive due to the narrowly defined developmental and socio-economic levels observed.

The superiority of learning with materials presented visually rather than aurally did not apply across all visual presentation conditions. Only the visual simultaneous conditions produced a significant difference in the mean number of correct responses when compared with the auditory mode of presentation. The evidence suggests that what appears to be a difference in visual and auditory modes of presentation may reflect differences in the ability of subjects to process information presented simultaneously and sequentially, a phenomenon which Paivio (1971) and Bower(1969) have discussed in relation to the encoding of spatial information by the visual system and of temporal information by the auditory system.

The present report strengthens the growing body of evidence that the influence of mode of presentation on learning is not a simple phenomenon; rather, many factors must be considered in predicting learning outcomes when different modes of presentation are being investigated. While the evidence reported does not support unequivocally a theoretical position, the evidence does indicate some practical implications for presenting materials to be learned by children at the developmental levels investigated. In order to facilitate the learning of associations, pictorial materials should be included and these materials should be presented in simultaneous visual arrays rather than in sequential presentations.

Table 1

Mean Number of Correct Responses as a Function of Age and Mode of Presentation

	Oral	Vis. Seq.	Vis. Sim.-2	Vis. Sim.-4
2 Yrs.	3.3	2.7	3.7	4.4
8 Yrs.	4.7	4.3	6.1	6.2
Mean	4.0	3.5	4.9	5.3

Table 2

Mean Number of Correct Responses as a Function of Age and Trial

	Trial 1	Trial 2	Trial 3	Mean
3 Yrs.	3.2	3.6	3.8	3.5
8 Yrs.	4.0	5.4	6.6	5.3
Mean	3.6	4.5	5.2	

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